

DEPARTMENT OF AGRICULTURE WEATHER PROGRAMS

Weather is the most important factor influencing the Nation's variability in crop yields and related production. The Nation's food and fiber products are a critical resource impacting our domestic and international economic position and have taken on new dimensions in foreign affairs and national security. The recent expansion in export markets has reduced stocks and benefitted our farm sectors as global consumption of total grains has exceeded production in 3 of the last 4 years. The United States Department of Agriculture (USDA) conducts supporting research that focuses on understanding the interactions of weather and climate with plants, animals, forests, and forest ecological systems, and assists the Department of Commerce in determining farmers' needs for weather information and in disseminating that information to them.

The World Agricultural Outlook Board (WAOB), in cooperation with National Weather Service's (NWS) Climate Prediction Center, staffs and supports the Joint Agricultural Weather Facility (JAWF). The JAWF monitors the daily weather patterns around the world. WAOB agricultural meteorologists convert the weather data into information to assess crop development and yield potential of all major commodity crops for the major producing areas of the world. Special weekly briefings are provided to the Secretary of Agriculture and to the economic and commodity analysts of USDA. The Senate and House Agricultural Committees also request periodic briefings on crop-related drought effects as in the 1988 and 1989 drought years and in the 1996 Southwest regional drought. In 1998 and 1999, El Niño and La Niña related drought briefings were requested by the House Agricultural Committee.

Historically, the Forest Service (FS) has collected meteorological data to assist in the control of forest fires and in the management of smoke from prescribed burning. Other activities also require weather data to ensure sound management decisions. To support these needs and requirements, a national weather program was established to coordinate all FS meteorological activities and to meet the increasing need for diverse weather information. The major objectives of the program are to: (1) improve quality con-

trol of weather data, (2) improve the design and operation of data collection from networks, (3) increase data recovery from the weather stations, and (4) upgrade station maintenance. Meteorological data collected from manual weather stations and Remote Automated Weather Stations (RAWS) support research of weather effects on forestry management, forest fires, smoke management, visibility protection in wilderness areas, and atmospheric deposition. A weather information management system and a library to archive all FS weather data are being developed in cooperation with regional climate centers. The FS monitoring network will provide essential data for use in Global Change Research Program (GCRP) work.

Currently, the FS operates more than 900 RAWS and manual stations, many in the western United States. Air temperature, relative humidity, soil moisture, wind direction and speed, and precipitation are transmitted via NOAA's Geostationary Operational Environmental Satellite (GOES) telemetry. These data are received via a direct-readout ground site in Boise, Idaho, in cooperation with the Bureau of Land Management. The main use of the data is in the calculation of the fire danger rating for the FS and cooperating agencies. These data are also used by other resource managers, such as, road engineers, wildlife biologists, and hydrologists who monitor precipitation; silviculturalists (who are attempt-

ing to maximize tree-planting opportunities); and ecologists, soil specialists, and fisheries biologists (who monitor the effects of runoff). Another major user of RAWS data is the NWS for fire weather forecasting and flood warnings.

The Natural Resources Conservation Service (NRCS) operates a network of 1,400 manual snow courses and over 550 automated data collection sites in conjunction with the Snow Telemetry (SNOTEL) project for the western United States and Alaska. The primary objective of the project is to forecast water supplies and streamflow for the coming spring run-off season. These measurements are made in cooperation with other federal, state, and local agencies, power companies, irrigation companies, and the provincial government of British Columbia.

Water-supply forecasts help irrigators make the most effective use of available streamflow for achieving their agricultural production goals. Farmers, who collectively irrigate more than 10 million acres of land in the western United States, benefit from these water supply forecasts. Other federal agencies and private organizations also use water supply forecast information to help them carry out their missions. These forecasts also help the federal government in administering international water treaties.

NRCS continues to upgrade the SNOTEL data collection system. The effort includes upgrading the data collection sites in the existing SNOTEL

system with new state-of-the-art equipment and adding additional sites. The data collection site upgrades include replacement of snow pillows, transducers, damaged precipitation gages, antennas, towers, solar panels, battery temperature sensors, and deteriorated shelter houses.

SUPPORTING RESEARCH

The mission of the USDA supporting research program is to develop and disseminate information and techniques to ensure high quality commodities and products while minimizing any adverse effects of agriculture on the environment. As part of the USDA reorganization, the Undersecretary for Research, Education, and Economics was created. This reorganization included the merger of the Cooperative State Research Service and the Extension Service, and the transfer of the Economic Research Service and the National Agricultural Statistics Service (NASS).

The research efforts of the Agricultural Research Service (ARS) relate directly to the effects of climate on agricultural production and the natural resource base. These efforts are directed toward developing technologies and systems for: (1) managing precipitation and solar energy for optimum crop production; (2) improving our understanding of water-plant-atmosphere interactions; (3) optimizing the use of energy, water, and agri-

cultural chemicals; (4) reducing plant and livestock losses from pests and environmental stress; (5) developing improved techniques for irrigation and drainage; and (6) minimizing the adverse effects of climate and weather, including atmospheric contaminants, on the environment.

The Cooperative State Research, Education, and Extensive Service (CSREES) coordinates research programs in the state agricultural experiment stations, the 1890 Land Grant Distributions, and cooperating forestry schools. These institutions conduct a wide variety of research applicable to agriculture and forestry. Meteorological research in these institutions is practically all climatological. A proportion of each state's program is consolidated into broad regional research projects. Animals and plants are subjected to many climatic stresses and, therefore, are the focus of this research. Research on the changes in levels of ultraviolet (UV) radiation as part of the GCRP was significantly expanded through the CSREES competitive grants program in FY 1994. The work is coordinated with EPA's UV radiation program and will support assessment efforts to develop related national policy on the environment.

Investigations by NASS support domestic crop estimating programs for all major commodities. Promising studies are underway to develop models relating weather parameters and

associated variables to corn ear weight and wheat head weight. Previous efforts to develop models for short-term forecasting have had only limited success. Research will continue in this area with the expectation that the relationships between weather variables and crop yield will improve as better plant process models become available and more information, such as soil moisture, are operationally observed.

A NASS program to explore the use of satellite and weather data for assessing crop conditions is continuing. A preliminary investigation using polar-orbiting meteorological satellite data showed a good relationship between crop conditions and reflectance data as determined by the agreement between measured and forecast final corn and soybean yields. The crop conditions assessment procedures, based on meteorological satellite data, are being automated and near real-time applications are being explored.

FS research includes efforts to: (1) understand and control forest fire initiation by lightning, (2) improve the translation of mid-range forecast elements to describe forestry conditions, (3) incorporate drought information into management decision-making, and (4) better describe how regional climatic variability affects the use of daily weather information by foresters. The FS long-term monitoring network will provide critical data for use in the GCRP work.